APPENDIX A

YUBA COUNTY DAMAGE SURVEY FOLLOWING 1997 FLOODS

US Army Corps of Engineers
Sacramento District

APPENDIX A

YUBA COUNTY DAMAGE SURVEY FOLLOWING 1997 FLOODS

A residential damage survey was conducted following the 1997 flooding in Reclamation District 784 in Yuba County, California. This appendix describes the study and presents the results of statistical analyses of survey responses.

BACKGROUND

The eastern levee of the Feather River failed on the evening of January 3, 1997, near the town of Arboga, California. Within 24 hours of the initial failure, the levee breach had reached more than 800 feet in length. Floodwaters inundated 12,000 acres, damaging more than 700 structures. Although the area was primarily agricultural, many of the damaged structures were concentrated along Country Club Road and in the town of Arboga. In total, approximately 600 residential structures were within the flooded area. This area had a wide range of flooding depths, with maximum depths about 20 feet (structures totally covered) in the south near the levee break to minimal depths in the north near the Yuba County Airport. Attachment 1 is a vicinity map of the region just north of Sacramento and south of Marysville. The approximate extent of flooding in the Arboga area during January 1997 is shown on Attachment 2.

The objective of the study was to develop area-specific data relating depth of flooding to damage costs. The study targeted approximately 200 to 300 residences, such that a representative distribution across all water depth ranges could be obtained. Due to the low number of commercial structures in the area, the survey was limited to residential structures.

Occupants of target residences were interviewed using the established residential flood damage questionnaire, included as Attachment 3. This questionnaire was supplied by the U.S. Army Corps of Engineers Institute for Water Resources (IWR) and is similar to a survey used in Grand Forks, North Dakota, following the April 1997 flooding. The questionnaire includes 20 questions to be answered by the homeowner to provide information regarding damages, costs, and preventative measures taken. In addition, 11 questions to be answered by the interviewer provide information related to the structure type, condition, and value.

The survey addressed emergency responses to the flooding and costs/damages incurred by the resident related to the flooding event. Costs incurred by the residents were categorized into three areas: structural damage costs, content damage costs, and nonphysical costs. While there are no quantitative data available on sediment and velocity of the flooding, the survey responses show a strong relationship between depth in relation to the first floor level, duration of flooding, and lead-time (from first knowing about the impending flood until the time of inundation).

A team of three California licensed real estate appraisers conducted the damage survey from June 26 to August 30, 1998. During this time, the team visited over 400 residences and surveyed over 300 residents within the survey area.

A total of 260 damage survey questionnaires were completed. Of the completed questionnaires, 115 of the residences did not have water in the home (water depth relative to the first floor was less than or equal to zero). The remaining 145 residences had measurable water depths within the home relative to the first floor. Depths ranged from several inches to over 28 feet above the first floor. A distribution of flooding depths reported in this study is shown on Figure A-1.
The primary difficulty encountered during this survey was obtaining an appropriate cross section of damaged homes to produce a depth-damage curve. Many residences in the southern portion of the survey area, where the most extensive damage occurred, were no longer standing. Many of the residents in this area are renters who were not present during the flooding and could not answer the surveys. In addition, some were unwilling to provide the information requested in the questionnaire.

OBSERVATIONS BY INTERVIEWERS

At the completion of the survey, each damage survey team member was asked to describe any additional observations or qualifications regarding the interviews or responses to the questions. Following observations were provided for questions on the questionnaire (Attachment 3).

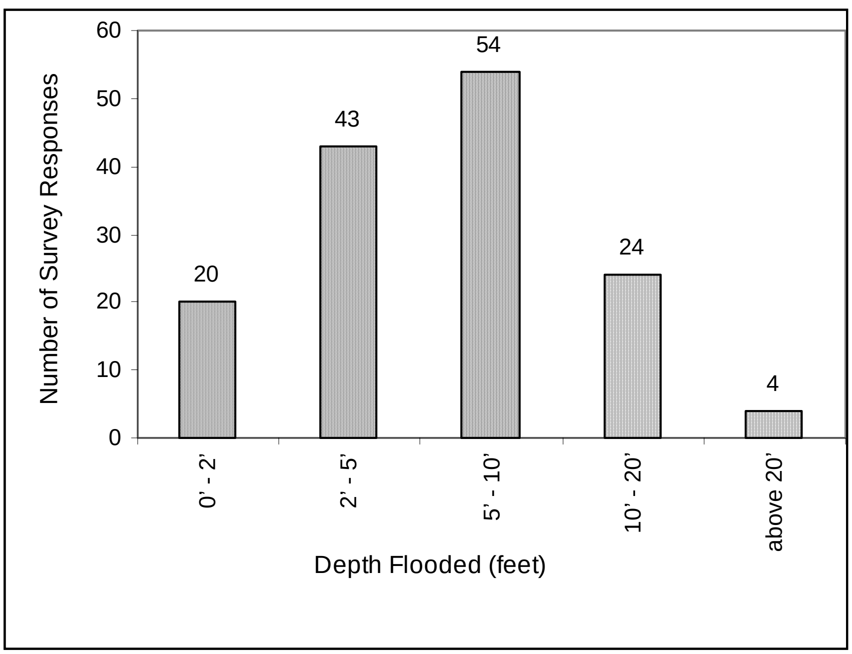

FIGURE A-1
RANGES OF FLOODING DEPTHS
YUBA COUNTY RESIDENTIAL DAMAGE SURVEY

Observations on Questions Answered Residents

Question 2 - Approximately how many times, including the 1997 flood, has this home been flooded? In some instance the resident did not live in the house in years prior to the January 1997 flood, and many have answered “no” to this question. However, if the resident did not live in the house at that time, they may not have had knowledge of that information. Whenever possible, the interviewer tried to clear this possibility with the resident.

Question 10 - Just before this year’s flood, how did you first become aware that flooding might reach your home? It is possible that there is more than one way the resident became aware that flooding might reach their home. In those instances, all warning sources were marked.

Question 16 - What was the dollar cost to you for labor and supplies to clean up the structure and contents of your house after the flood? In many instances the dollar cost for labor and supplies was included in *Question 14 - What was the structural damage to your home?* Residents stated that many of the supplies used were donated by Red Cross, churches, and large manufacturing companies which make cleaning products.

Question 17 - What was the total number of unpaid hours that you and others spent on repair and cleanup to your home and its contents? The number of unpaid hours that residents spent on repair and cleanup caused a lot of calculation on their part. This was a very difficult question for them to answer. The interviewer was able to guide them through the process by asking them how many days they worked, how many people did the work, and how many hours per day they worked. Then calculation could be done with some degree of accuracy.

Question 18d - How much, if anything, did each of the following cost you in actual dollar expenditures as a result of all of the flooding this year: Cost of flooding-related medical problems? Although there were very few residents who responded with a dollar amount here, there were many who stated stress as a continuing problem. Other responses were rashes and allergies which they attributed to the mold and the harmful substances in the water during the flooding. One woman drowned while trying to evacuate. This question was difficult to quantify with a dollar amount. Tetanus shots were supplied free.

Question 19 - How high in feet and inches did the water get relative to the first floor inside your home? Even though the water was below the first floor inside the home, damage from flooding often occurred in ground-level garages. The raised floor inside the home saved them from damage other than water running under the house.

Question 20 - How many hours did the water remain in your home? Conversion was required from days to hours because of the extended time the water remained in their homes. Many residents could not answer this question because they were not allowed back in the area until days after the water had receded.

Observations on Questions Answered by Interviewer

Question 11 - Not counting the basement, attic, or garage, what percentage of the interior walls and ceilings in this home are covered in plaster? Few of the houses surveyed had plaster walls. Almost all the homes had drywall, gypsum board interior walls. There were some exceptions on concrete block structures where the interior walls were exposed concrete block.

SURVEY RESULTS

The IWR conducted a statistical analysis of the damage survey data to develop depth-damage relationship curves and to evaluate other relevant information regarding resident responses to prevent damages and warning time. The evaluated data were derived from 140 completed damage surveys associated with properties with measurable flood depth above first floor level. The distribution of data related to different structure types is summarized in Table A-1. As indicated, most residential property in the Arboga area consists of single-story, single-family structures with no basements. Most of the structures are constructed of wood or stucco.

ANALYSIS OF SURVEY RESULTS

The analysis of the Feather River Flood Damage Data Survey can be summarized into four areas: depth-damage analysis, nonphysical flood costs, vehicle damage, and flood emergency response. The analysis was based on 140 surveys where the survey response was sufficiently complete to analyze and where there was either structural or content damage. The analysis procedures and results are summarized below.

TABLE A-1
FREQUENCIES OF STRUCTURE TYPE

	Frequency	Percent	Cumulative Percent
One-Story, No Basement	123	87.9	87.9
One-Story, With Basement	6	4.3	92.1
Two- or More Stories, No Basement	9	6.4	98.6
Two- or More Stories, With Basement	1	0.7	99.3
Split Level, No Basement	1	0.7	100.0
Total	140	100.0	

DEPTH-DAMAGE ANALYSIS

Structure and content depth-damage functions were developed using regression analysis. Several functional formats and variable combinations were explored in constructing the model. A cubic form was adopted for all of the depth-damage functions, where depth, depth squared, and depth cubed were the only independent variables used to explain variation in the value of percent damage to structure.

Percent damage-to-structure was computed by dividing structure damage by structure value for each responding household. The percent damage-to-contents statistic was calculated by dividing content damage by structure value for each response. Content value for each household was not determined because of the anticipated time and expense and because it was believed that the ratio of content damage to structure value would be a suitably reliable proxy to the content-damage-to-content-value ratio.

Only the single-story without-basement structure and content models had a sufficient number of cases to produce reliable regression models. There were 111 cases for the structure damage model and 85 cases for the content damage model. With adjusted R-squared statistics of 0.227 for percent damage-to-structure and 0.103 for percent damage-to-contents, the models were considered significant for cross sectional data on a highly variable phenomenon.

Variables eliminated from the models included exterior construction material, duration of flooding, and flood warning lead time. The cubic format was required because of significant changes in the rate that damage occurs as depth increases. The structural damage function for single-story homes with no basement begins with very low damage at the first floor level, rises very quickly through the 2-½ to 3 foot level, then flattens out and becomes almost completely flat at about 70 percent damage for the 11 to 20 feet above first floor range. The content damage function had a similar slope with damage rising a bit more slowly throughout the lower depths and topping out at more than 9 feet above the first floor level with content damage at approximately 40 percent of structure value.

A statistical analysis of flood damages (both incurred and prevented) and emergency responses was conducted. Flood damages incurred by the residents were organized into three categories:

- structural damage costs
- content damage costs
- nonphysical costs

STRUCTURAL DAMAGE COSTS

A statistical analysis was performed on structural damage data. For this analysis, structural damage is expressed as the cost of flood damages to the structure relative to the value of the residence (structure). Thus, structural damage is expressed as a percent of the structure value.

Structural value for each residence was estimated using Marshall and Swift Valuation. Structural damage data was divided into three categories based on structure type.

- one-story residence with no basement
- one-story residence with a basement
- two- or more story residence with no basement

For each structure type, a regression equation was developed relating structural damages incurred to the structural estimated value. Tables A-2 lists the estimate of error for each regression, and Table A-3 summarizes the analysis of variance for each regression. The limited availability of data and corresponding limited correlation for one-story with basement (6) and two or more stories with no basement (9) structures is reflected in the summary statistics.

Table A-4 lists estimated structural damages for single-story properties with no basement. Estimated damages, based on data obtained from the survey data, are shown as percent of structural value for flooding depths ranging from zero foot to 27 feet above the first floor level. This table also presents national average structural damage percentages, as reported by FIA, for flooding depths ranging from zero foot to 16 feet above first floor level.

Figure A-2 compares study results and FIA national average structural damage percentages for single-story properties with no basement. As shown, estimated structural damages in the Arboga area exceed national average damages. This probably reflects the relatively high structural damage that occurs on wood and stucco structures. National averages are based on a damages to single-story residences constructed of a variety of materials. In general, flood damages to brick or masonry structures would be expected to be lower than to wood and stucco structures at similar flooding depths.

Table A-5 lists estimated structural damages for single-story properties with basements. Estimated damage, based on data obtained from the survey data, are shown as percent of structural value for flooding depths ranging from zero foot to 18 feet above the first-floor level. These results are shown on Figure A-3.

TABLE A-2
MODEL SUMMARY OF STRUCTURAL DAMAGE REGRESSION

Structure Type	R	R Square	Adjusted R Square	Standard Error of the Estimate
One-Story, No Basement	0.542	0.293	0.275	0.274
One-Story, With Basement	0.964	0.929	0.822	0.139
Two- or More Story, No Basement	0.828	0.685	0.449	0.133

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TABLE A-3
ANALYSIS OF VARIANCE (ANOVA) SUMMARY FOR STRUCTURAL DAMAGE

Structure Type		Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
One-Story,	Regression	3.530	3	1.177	15.647	.000
No Basement	Residual	8.497	113	0.0752		
	Total	12.027	116			
One-Story,	Regression	0.501	3	0.167	8.674	0.105
With Basement	Residual	0.0385	2	0.019		
	Total	0.540	5			
Two- or More	Regression	0.155	3	0.052	2.905	0.165
Story, No	Residual	0.017	4	0.018		
Basement	Total	0.226	7			

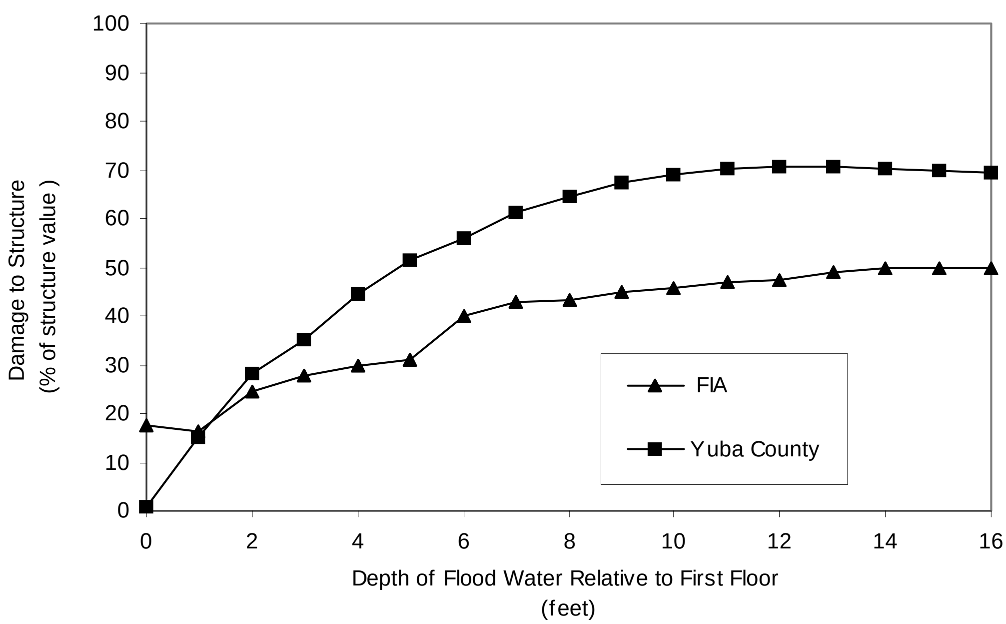


FIGURE A-2
DAMAGE TO STRUCTURE VERSUS FLOOD DEPTH
ONE-STORY, NO-BASEMENT STRUCTURE

TABLE A-4
STRUCTURAL DAMAGE REGRESSION MODEL RESULTS
ONE-STORY, NO-BASEMENT STRUCTURES

Depth of Floodwater Relative to First Floor (Feet)	Yuba County Structural Damage (% of structural value)	FIA Structural Damage* (% of structural value)
0	0.76%	17.40%
1	14.95%	16.33%
2	28.02%	24.69%
3	35.00%	27.72%
4	44.58%	29.64%
5	51.42%	30.86%
6	55.98%	39.82%
7	61.34%	42.76%
8	64.55%	43.32%
9	67.26%	44.80%
10	69.11%	45.79%
11	70.05%	46.96%
12	70.63%	47.34%
13	70.67%	48.89%
14	70.28%	49.68%
15	69.89%	49.92%
16	69.30%	49.77%
19	68.05%	
20	68.26%	
27	91.62%	
** - Federal Insurance Administration national average		

TABLE A-5
STRUCTURAL DAMAGE REGRESSION MODEL RESULTS
ONE-STORY, WITH-BASEMENT STRUCTURE

Depth of Floodwater Relative to First Floor (feet)	Yuba County Structural Damage (% of structural value)
1	9.62%
5	90.79%
6	89.74%
7	84.20%
9	64.09%
18	47.69%

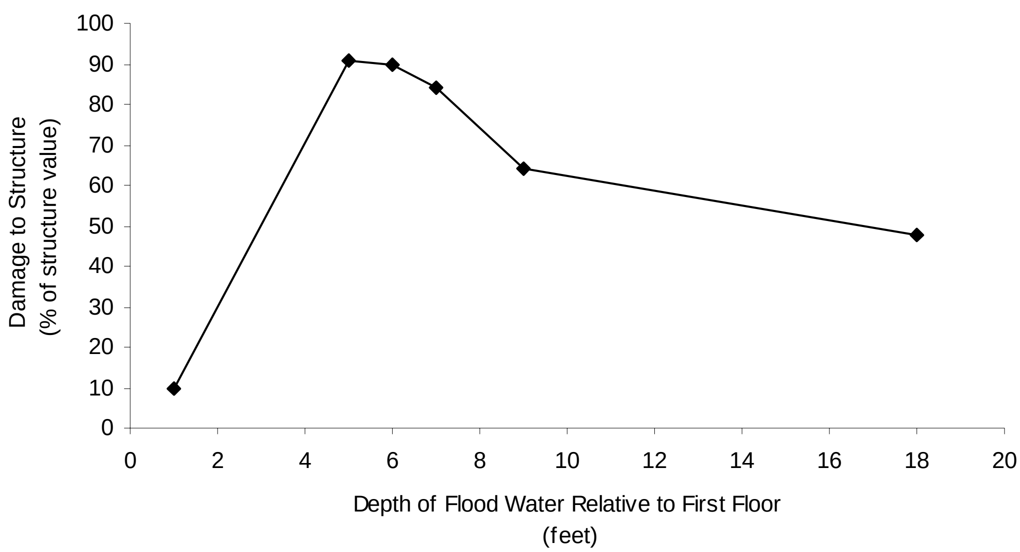


FIGURE A-3
DAMAGE TO STRUCTURE VERSUS FLOOD DEPTH
ONE-STORY WITH BASEMENT

Table A-6 lists estimated structural damages for two- or more story properties with no basements. Estimated damages, based on data obtained from the survey data, are shown as percent of structural value for flooding depths ranging from zero foot to 23 feet above the first-floor level. These results are shown graphically in Figure A-4.

CONTENT DAMAGE COSTS

A statistical analysis was also performed on content damage data, with content damage expressed as percentage of the structure value. Structural value for each residence was estimated using Marshall and Swift Valuation. Content damage data were divided into two categories based on structure type:

- one-story residence
- two- or more story residence

For each structure type, a regression equation was developed relating content damages incurred to the structural estimated value. Table A-7 lists the estimate of error for each regression, and Table A-8 summarizes the analysis of variance for each regression. The limited availability of data corresponding to two-story residences is reflected in the summary statistics.

Table A-9 lists estimated content damages for single-story properties. Estimated damage, based on data obtained from the survey data, are shown as percent of structural value for flooding depths ranging from zero foot to 27 feet above the first-floor level. This table also presents national average content damage percentages, as reported by FIA, for flooding depths ranging from zero foot to 10 feet above first-floor level. Figure A-5 compares study results and FIA national average content damage percentages for single-story properties. As shown, estimated structural damages in the Arboga area were less than national average damages.

NONPHYSICAL COSTS

In addition to structural and content damages, residents incurred incidental costs related to the January 1997 flooding. These incidental costs include additional expenses incurred by the resident due to evacuation from their residence and/or costs to relocate costs during reconstruction of the structure. Other incidental cost are for cleanup, value of items stolen/looted, and the value of unpaid hours for cleanup/repair. Nonphysical costs, reported as dollar values, associated with flooding are summarized on Table A-11. Nonphysical costs are presented as a percentage of structural value on Table A-12.

Depth, duration, sediment, and velocity can all be expected to have significant impacts on nonphysical costs of flooding. Each of these factors will tend to directly increase the level of structure damage and increase the amount of time a household is forced to temporarily relocate. Long duration flooding can cause extended relocation even at lower depths. Velocity and sediment load can intensify road damage and increase transportation rerouting costs.

TABLE A-6
STRUCTURAL DAMAGE REGRESSION MODEL RESULTS
TWO- OR MORE STORIES NO-BASEMENT

Depth of Floodwater Relative to First Floor (feet)	Yuba County Structural Damage (% of structural value)
4	25.42%
6	49.97%
8	59.07%
12	60.20%
13	57.57%
15	53.63%
16	52.15%
23	79.29%

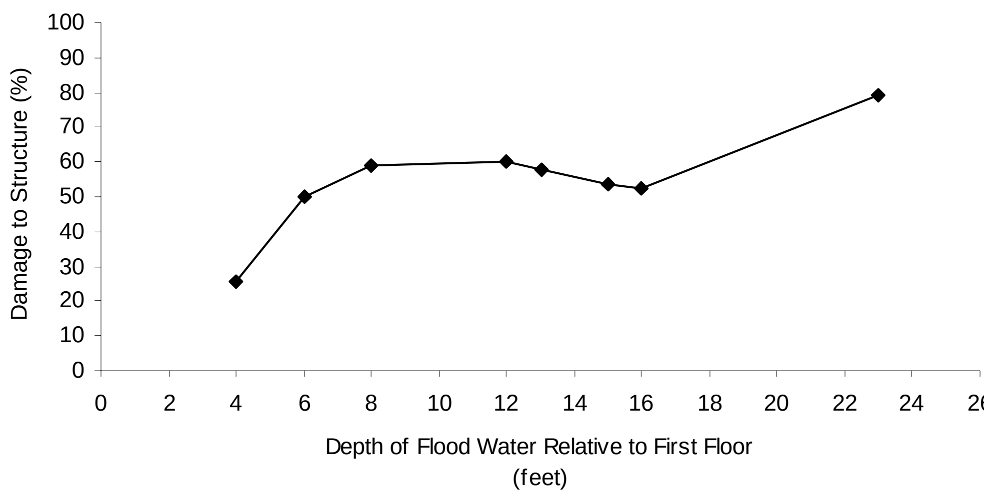


FIGURE A-4
DAMAGE TO STRUCTURE VERSUS FLOOD DEPTH
TWO STORIES NO-BASEMENT

TABLE A-7
MODEL SUMMARY OF CONTENT DAMAGE REGRESSION

Structure Type	R	R Square	Adjusted R Square	Standard Error of the Estimate
One-Story	0.355	0.126	0.102	0.234
Two-Story	0.722	0.522	0.235	0.137

TABLE A-8
ANALYSIS OF VARIANCE (ANOVA) SUMMARY FOR CONTENT DAMAGE

Structure Type		Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
One-Story	Regression	0.863	3	0.288	5.254	0.002
	Residual	5.968	109	0.055		
	Total	6.831	112			
Two-Story	Regression	0.102	3	0.034	1.818	0.261
	Residual	0.093	5	0.019		
	Total	0.195	8			

TABLE A-9
CONTENT DAMAGE REGRESSION MODEL RESULTS
ONE-STORY STRUCTURE

Depth of Floodwater Relative to First Floor (feet)	Yuba County Content Damage (% of structural value)	FIA Content Damage (% of structural value)
0	3.76%	12.15%
1	11.21%	24.05%
2	18.78%	32.73%
3	22.63%	34.74%
4	27.90%	36.99%
5	31.67%	40.77%
6	34.16%	44.89%
7	36.98%	49.87%
8	38.59%	54.70%
9	39.90%	59.83%
10	40.57%	59.75%
11	40.76%	
12	40.52%	
13	40.26%	
14	39.04%	
15	38.21%	
16	36.95%	
18	33.67%	
19	32.91%	
20	30.66%	
27	25.80%	
** - Federal Insurance Administration national average		

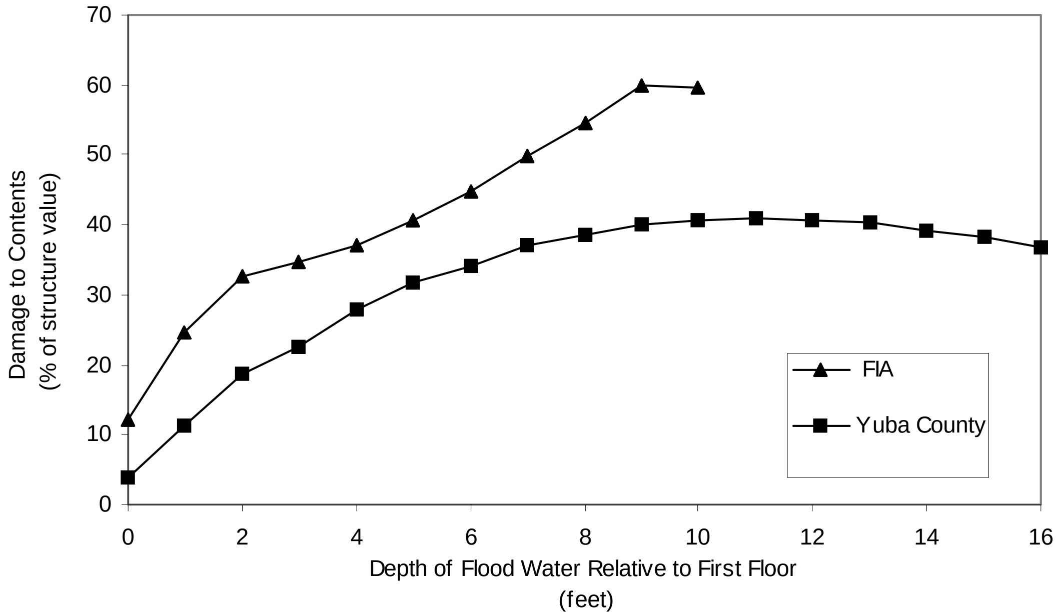


FIGURE A-5
DAMAGE TO CONTENTS VERSUS FLOOD DEPTH
ONE-STORY STRUCTURE

TABLE A-10
CONTENT DAMAGE REGRESSION MODEL RESULTS FOR TWO- OR MORE STORY STRUCTURE

Depth of Floodwater Relative to First Floor (feet)	Yuba County Content Damage (% of structural value)
1	9.62%
5	90.79%
6	89.74%
7	84.20%
9	64.09%
18	47.69%

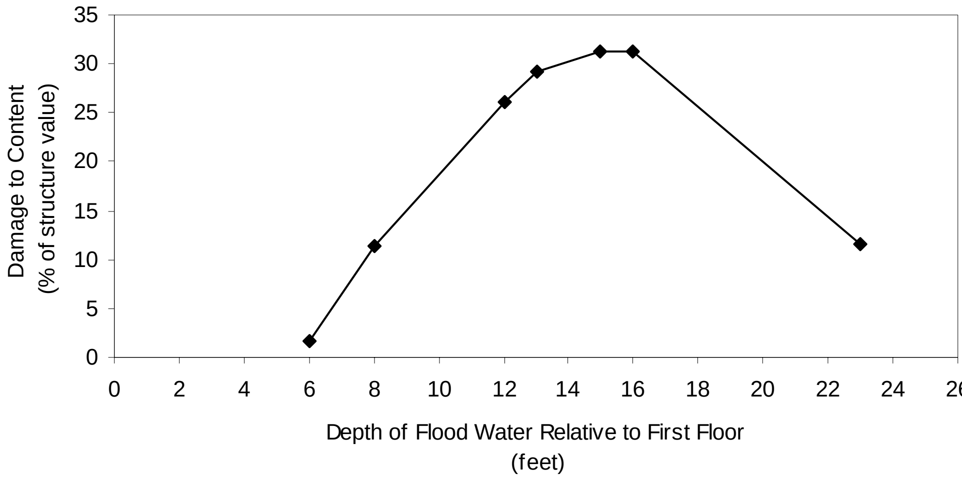


FIGURE A-6
DAMAGE TO CONTENTS VERSUS FLOOD DEPTH
TWO- OR MORE STORY STRUCTURE

TABLE A-11
NONPHYSICAL COSTS OF FLOODING

Non Physical Costs	N	Minimum	Maximum	Mean	Standard Deviation	Skewness
Cleanup Costs	51	$0.00	$50,000.00	$3,498.04	$9,799.44	3.72
Extra Food Costs	116	$0.00	$10,000.00	$524.87	$1,252.81	5.08
Medical Costs	124	$0.00	$4,000.00	$126.01	$547.85	5.16
Moving Furniture and Other Belongings	126	$0.00	$10,000.00	$90.83	$891.96	11.15
Other Costs	123	$0.00	$55,000.00	$2,223.74	$8,069.89	5.02
Storing Furniture Costs	126	$0.00	$3,600.00	$132.56	$491.99	5.93
Extra Travel and Lodging Costs	120	$0.00	$17,000.00	$1,659.25	$2,526.56	3.10
Unpaid Hours for Cleanup and Repair (reported in hours)	119	0	6480	1116.09	1223.51	2.41
Cost of Unpaid Hours at Minimum Wage	119	$0.00	$33,372.00	$5,747.88	$6,301.05	2.41
Vandalism and Looting Costs	124	$0.00	$15,000.00	$788.31	$2,260.87	4.08

TABLE A-12
NONPHYSICAL COSTS OF FLOODING
RELATIVE TO STRUCTURE DAMAGE COSTS

Nonphysical Costs Relative to Structure Damage Costs	N	Minimum	Maximum	Mean	Standard Deviation	Skewness
Cleanup Costs/Structure Damage Costs	45	0	0.83	0.0737	0.1689	3.276
Extra Food Cost/Structure Damage	109	0	0.38	0.0141	0.0439	6.337
Medical Cost/Structure Damage	120	0	0.13	0.0037	0.0168	5.830
Moving Furniture and Other Belongings Costs/Structure Damage Cost	121	0	0.33	0.0035	0.0308	10.509
Other Cost/Structure Damage	119	0	0.71	0.0372	0.1090	3.821
Storing Furniture Costs/Structure Damage	122	0	0.06	0.0028	0.0080	4.422
Travel Costs/Structure Damage	113	0	0.39	0.0414	0.0713	2.975
Unpaid Hours as a Percent of Structure Damage	109	0	0.93	0.1462	0.1645	1.972
Vandalism and Looting/Structure Damage	119	0	0.5	0.0176	0.0635	5.712
Nonphysical Cost as a Percent of Physical Costs	122	0	1.25	0.272	0.2708	1.426

Correlation data indicated a very strong relationship between depth of water relative to the first floor and days spent in temporary residence. Duration of flooding and days spent in temporary housing were also highly correlated. The relationship between depth, duration, lead-time and other nonphysical costs were very low in this analysis. It is possible that the correlations and predictive value of these relationships would grow stronger when taken over a larger cross section of post flood data.

Nonphysical flood damage amounted to more than 34 percent of the structural cost of flooding. Nonphysical costs included the monetary value of cleanup (including the paid hours of cleanup time valued at the minimum wage), added costs of food, temporary lodging, commuting, furniture moving and storage expense, flood-related medical expenses, vandalism, and other miscellaneous expenses. Cleanup and the unpaid hours for cleanup accounted for approximately 81 percent of the total nonphysical costs. Travel, lodging, and food were also significant costs.

FLOOD EMERGENCY RESPONSE

Many residents took preventive actions when informed of the need to evacuate the area. These actions included moving contents from structure or to higher points within the structure. These and similar actions prevented damage to the contents of the structure. Table A-13 summarizes the number and percentage of residents included in this survey who took actions to prevent damages.

Overall, the limited amount of lead time and the severity of the flooding greatly limited the amount of damage prevention. Content damage averaged $592.44, and there were no structural damages prevented. Vehicle damage prevented is described above. Generally, a higher damage-prevented figure might be expected with an average of 11.6 hours of lead time, but the high levels of flooding made it very ineffective to prevent damage by raising contents to higher places within the home or moving contents to nearby higher ground. The flood emergency response variables indicate the percent of households taking the various response options. Approximately 38 percent of the respondents took no action. Elevating contents to a higher place in the home and moving vehicles to higher ground were the most common preventive actions at 44 percent and 40 percent each. Other than moving contents to higher ground, at 14.3 percent response, no other action had as much as a 10 percent response.

Table A-14 summarizes statistics of prevented structural and content damages and warning times.

VEHICLE DAMAGES

Of 319 vehicles parked in the area at time of the flooding, 132 vehicles, or 41 percent of the vehicles, were moved out of the area and 187 were not moved. Nearly all the vehicles that were not moved were damaged. Sedans had an average of $5,387 damage, with damage averaging 92.5 percent of vehicle value. Pickup trucks had average of $5,271 damage, with damage averaging 88.9 percent of vehicle value. Sports utility vehicles had an average of $2,433 damage, with damage averaging 85.9 percent of vehicle value. Flood levels were such that 80 percent of the vehicles that were not moved were totaled. Sedans tended to be totaled at inundation levels 3 feet and more above the wheel base. Pickups and sport utility vehicles were totaled at levels 5 feet over the wheel base.

TABLE A-13
ACTIONS TAKEN BY RESIDENTS
TO SAFEGUARD HOME PRIOR TO FLOODING

Action Taken to Safeguard Property	Count (140 total responses)		Percentage	
	no	yes	no	yes
Moved contents to higher ground	120	20	85.7%	14.3%
Elevated contents to a higher place in the building	96	44	68.6%	44.0%
Shut off electrical equipment	129	11	92.1%	7.9%
Moved vehicles to higher ground	84	56	60.0%	40.0%
Sandbagged the outside of the building	129	11	92.1%	7.9%
Used another type of temporary barrier	140	0	100.0%	0.0%
Other preventive actions	128	12	91.4%	8.6%
No preventive actions	87	53	62.1%	37.9%

TABLE A-14
DESCRIPTIVE STATISTICS FOR
PREVENTED DAMAGES AND WARNING TIME

	N	Minimum	Maximum	Mean	Standard Deviation
Structure Damage Prevented	119	$0.00	$0.00	$0.00	$0.00
Content Damage Prevented	120	$0.00	$10,000.00	$592.44	$1,873.05
Number of hours of warning time	119	0	72.0	11.6	15.4

TABLE A-15
CORRELATION BETWEEN EMERGENCY RESPONSES, PREVENTED DAMAGES AND WARNING TIMES

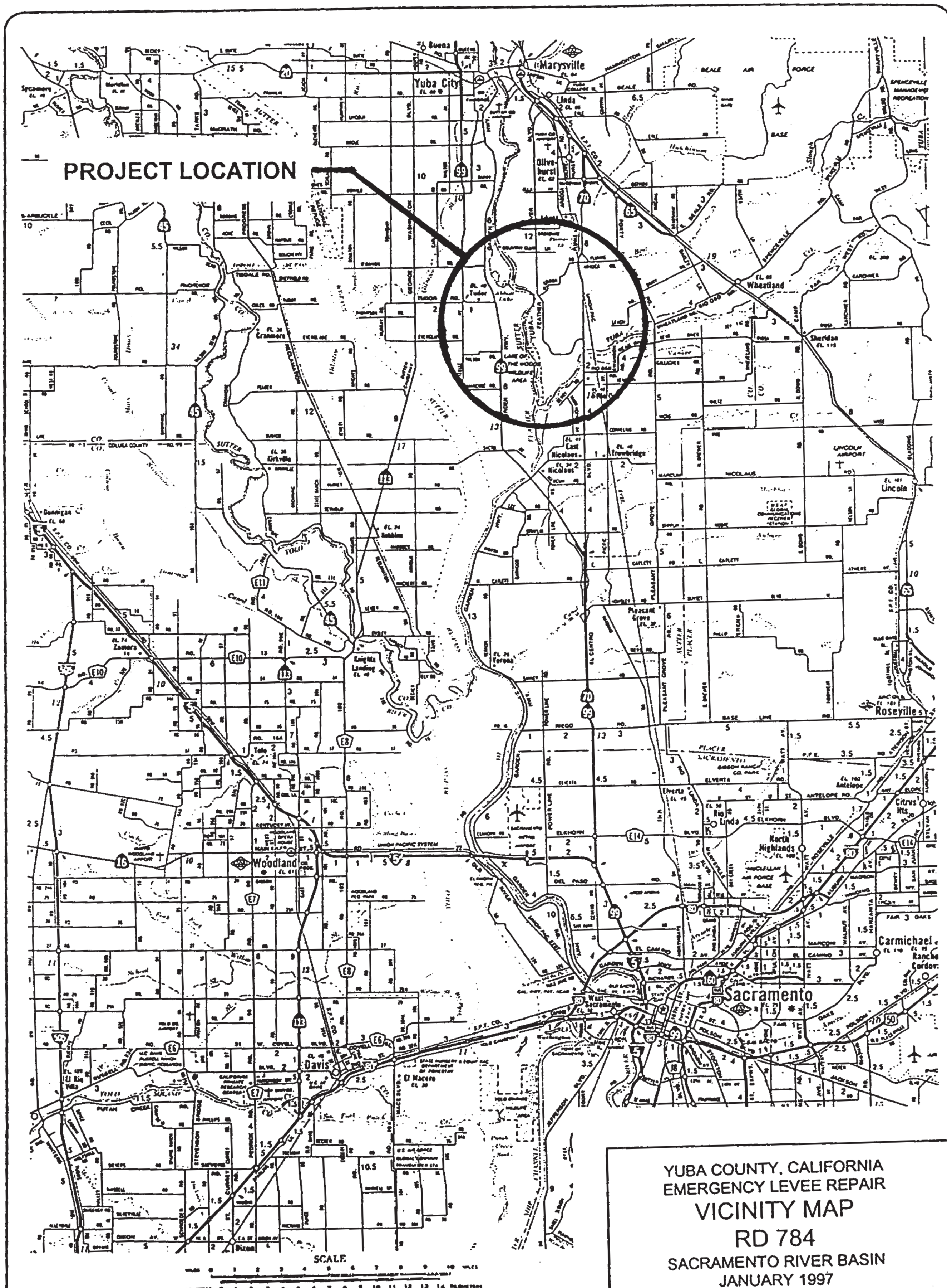
Correlations

		CONTPREV Content Damage Prevented	LEADTIME Number of Hours Warning Time	DEPTH Depth of Water Relative to First Floor	CONTDAM Content Damage	ELECOFF Cut off Electricity?	HIBLDG Moved to Higher Place in Building?	HIGRND Moved Contents to Higher Gound?	MOVEVHL Moved Vehicles to Higher Ground?	SANDBAG Sandbag Outside Home?	OTHBARR Used Another Type of Barrier?	OTHACTN Other Damage Preventive Actions	NOACTION No Preventive Actions
CONTPREV Content Damage Prevented	Pearson Correlation	1.000	.000	-.098	-.091	.091	.034	.322**	.133	.007	.[a]	.008	-.152
	Sig. (2-tailed)	.	1.000	.255	.318	.291	.695	.000	.121	.936	.	.925	.075
	Sum of Squares and Cross-products	2.850E+09	-314.058	-332563.1	-1.81E+09	15378.986	9790.580	69681.884	40820.290	1178.986	.000	1378.986	-46355.797
	Covariance	1.000	-2.617	-2445.317	-14795702	112.255	71.464	508.627	297.958	8.606	.000	10.066	-338.363
	N	.	121	137	123	138	138	138	138	138	138	138	138
LEADTIME Number of Hours Warning Time	Pearson Correlation	2.850E+09	1.000	-.195*	-.114	.054	-.031	.244**	-.004	-.020	.[a]	-.034	-.082
	Sig. (2-tailed)	20804534.5	.	.032	.235	.558	.733	.007	.966	.829	.	.709	.371
	Sum of Squares and Cross-products	138	96280.268	-3443.713	-12292343	52.564	-50.734	296.750	-6.436	-19.436	.000	-32.136	-135.036
	Covariance	.000	795.705	-28.698	-112773.8	.434	-.419	2.452	-5.319E-02	-.161	.000	-.266	-1.116
	N	1.000	122	121	110	122	122	122	122	122	122	122	122
DEPTH Depth of Water Relative to First Floor	Pearson Correlation	-314.058	-.195*	1.000	.373**	-.083	-.025	-.158	-.001	-.137	.[a]	.083	.039
	Sig. (2-tailed)	-2.617	.032	.	.000	.333	.770	.063	.993	.107	.	.333	.648
	Sum of Squares and Cross-products	121	-3443.713	4055.684	8019892.7	-16.767	-8.748	-41.613	-.266	-26.636	.000	17.432	14.236
	Covariance	-.098	-28.698	29.389	65202.380	-.122	-6.339E-02	-.302	-1.925E-03	-.193	.000	.126	.103
	N	.255	121	139	124	139	139	139	139	139	139	139	139
CONTDAM Content Damage	Pearson Correlation	32563.109	-.114	.373**	1.000	-.077	.061	-.116	-.075	.011	.[a]	.109	.002
	Sig. (2-tailed)	-2445.317	.235	.000	.	.390	.502	.198	.407	.902	.	.225	.984
	Sum of Squares and Cross-products	137	-12292343	8019892.7	1.40E+11	-91852.000	113880.00	-174108.0	-152768.0	12680.000	.000	134616.00	3632.000
	Covariance	-14795702	-112773.8	65202.380	1.13E+09	-740.742	918.387	-1404.097	-1232.000	102.258	.000	1085.613	29.290
	N	123	110	124	125	125	125	125	125	125	125	125	125
ELECOFF Cut off Electricity?	Pearson Correlation	.091	.054	-.083	-.077	1.000	.145	.336**	.195*	.211*	.[a]	.100	-.228**
	Sig. (2-tailed)	.291	.558	.333	.390	.	.086	.000	.021	.012	.	.239	.007
	Sum of Squares and Cross-products	15378.986	52.564	-16.767	-91852.000	10.136	2.543	4.429	3.600	2.136	.000	1.057	-4.164
	Covariance	112.255	.434	-.122	-740.742	7.292E-02	1.829E-02	3.186E-02	2.590E-02	1.536E-02	.000	7.605E-03	-2.996E-02
	N	138	122	139	125	140	140	140	140	140	140	140	140
HIBLDG Moved to Higher Place in Building?	Pearson Correlation	.034	-.031	-.025	.061	.145	1.000	.075	.107	.203*	.[a]	.068	-.497**
	Sig. (2-tailed)	.695	.733	.770	.502	.086	.	.376	.209	.016	.	.428	.000
	Sum of Squares and Cross-products	9790.580	-50.734	-8.748	113880.00	2.543	30.171	1.714	3.400	3.543	.000	1.229	-15.657
	Covariance	71.464	-.419	-6.339E-02	918.387	1.829E-02	.217	1.233E-02	2.446E-02	2.549E-02	.000	8.839E-03	-.113
	N	138	122	139	125	140	140	140	140	140	140	140	140
HIGRND Moved Contents to Higher Gound?	Pearson Correlation	.322**	.244**	-.158	-.116	.336**	.075	1.000	.125	.108	.[a]	.021	-.319**
	Sig. (2-tailed)	.000	.007	.063	.198	.000	.376	.	.141	.202	.	.807	.000
	Sum of Squares and Cross-products	69681.884	296.750	-41.613	-174108.0	4.429	1.714	17.143	3.000	1.429	.000	.286	-7.571
	Covariance	508.627	2.452	-.302	-1404.097	3.186E-02	1.233E-02	.123	2.158E-02	1.028E-02	.000	2.055E-03	-5.447E-02
	N	138	122	139	125	140	140	140	140	140	140	140	140
MOVEVHL Moved Vehicles to Higher Ground?	Pearson Correlation	.133	-.004	-.001	-.075	.195*	.107	.125	1.000	.195*	.[a]	.010	-.607**
	Sig. (2-tailed)	.121	.966	.993	.407	.021	.209	.141	.	.021	.	.903	.000
	Sum of Squares and Cross-products	40820.290	-6.436	-.266	-152768.0	3.600	3.400	3.000	33.600	3.600	.000	.200	-20.200
	Covariance	297.96	-5.319E-02	-1.925E-03	-1232.000	2.590E-02	2.446E-02	2.158E-02	.242	2.590E-02	.000	1.439E-03	-.145
	N	138.00	122	139	125	140	140	140	140	140	140	140	140
SANDBAG Sandbag Outside Home?	Pearson Correlation	297.96	-.020	-.137	.011	.211*	.203*	.108	.195*	1.000	.[a]	-.089	-.228**
	Sig. (2-tailed)	138.00	.829	.107	.902	.012	.016	.202	.021	.	.	.293	.007
	Sum of Squares and Cross-products	.01	-19.436	-26.636	12680.000	2.136	3.543	1.429	3.600	10.136	.000	-.943	-4.164
	Covariance	.94	-.161	-.193	102.258	1.536E-02	2.549E-02	1.028E-02	2.590E-02	7.292E-02	.000	-6.783E-03	-2.996E-02
	N	1178.99	122	139	125	140	140	140	140	140	140	140	140
OTHBARR Used Another Type of Barrier?	Pearson Correlation	8.61[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]
	Sig. (2-tailed)	138.00	.	.	.	.	.	.	.	.	.	.	.
	Sum of Squares and Cross-products	.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	Covariance	.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	.00	122	139	125	140	140	140	140	140	140	140	140
OTHACTN Other Damage Preventive Actions	Pearson Correlation	.00	-.034	.083	.109	.100	.068	.021	.010	-.089	.[a]	1.000	-.239**
	Sig. (2-tailed)	138.00	.709	.333	.225	.239	.428	.807	.903	.293	.	.	.004
	Sum of Squares and Cross-products	.01	-32.136	17.432	134616.00	1.057	1.229	.286	.200	-.943	.000	10.971	-4.543
	Covariance	.92	-.266	.126	1085.613	7.605E-03	8.839E-03	2.055E-03	1.439E-03	-6.783E-03	.000	7.893E-02	-3.268E-02
	N	1378.99	122	139	125	140	140	140	140	140	140	140	140
NOACTION No Preventive Actions	Pearson Correlation	10.07	-.082	.039	.002	-.228**	-.497**	-.319**	-.607**	-.228**	.[a]	-.239**	1.000
	Sig. (2-tailed)	138.00	.371	.648	.984	.007	.000	.000	.000	.007	.	.004	.
	Sum of Squares and Cross-products	-.15	-135.036	14.236	3632.000	-4.164	-15.657	-7.571	-20.200	-4.164	.000	-4.543	32.936
	Covariance	.08	-1.116	.103	29.290	-2.996E-02	-.113	-5.447E-02	-.145	-2.996E-02	.000	-3.268E-02	.237
	N	-46355.80	122	139	125	140	140	140	140	140	140	140	140

**. Correlation is significant at the 0.01 level (2-tailed).

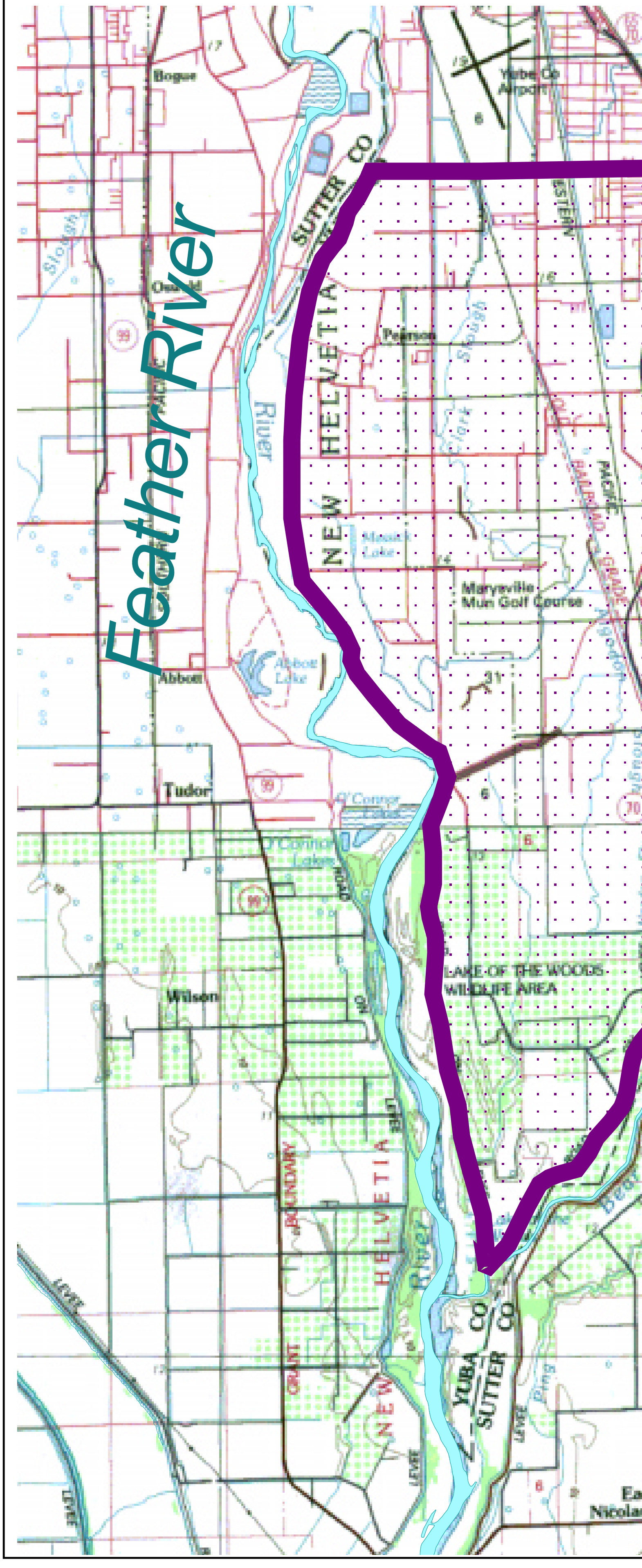
*. Correlation is significant at the 0.05 level (2-tailed).

a. Cannot be computed because at least one of the variables is constant.



CORPS OF ENGINEERS, SACRAMENTO DISTRICT

ATTACHMENT 1



POST FLOOD ASSESSMENT FOR
1983, 1986, 1995, and 1997

AREA FLOODED
(Approximate Floodplain Highlighted)
JANUARY, 1997
YUBA COUNTY, CALIFORNIA

U.S. Army Corps of Engineers
Sacramento District

March 1999

ATTACHMENT 2

ATTACHMENT 3

U.S. ARMY CORPS OF ENGINEERS
RESIDENTIAL FLOOD DAMAGE QUESTIONNAIRE
FOR THE JANUARY 1997 FLOOD

1. How many years have you lived at this address?

    ________________ YEARS **(YRSRES)**

2. Before the flood this year, had your home ever been flooded? (CIRCLE)

    1. NO
    2. YES **(FLOODB4)**

3. Approximately how many times, including the 1997 flood, has this home been flooded?

    ______ TIMES **(NUMFLD)**

4. Do you own or rent your home? **(CIRCLE)**

    1. OWN (or have mortgage)
    2. RENT
    3. OTHER (Please Specify:) _________________ **(OWNRENT)**

5. How old is your home?

    ______ YEARS OLD **(HOMEAGE)**

6. Not counting your basement, attic, or garage, how many square feet of living area are in your home?

    ___________ SQUARE FEET **(SQFT)**

7. Does your home have a basement? (CIRCLE)

1. NO (Skip to 8)
2. YES **(BSMT)**

7a. If yes, please indicate the total basement area, in square feet, and the amount that is finished and unfinished?

TOTAL BASEMENT AREA: ______________ SQUARE FEET **(BSMTSQFT)**

FINISHED BASEMENT AREA: ___________ SQUARE FEET **(BSMTFIN)**

UNFINISHED BASEMENT AREA: ________ SQUARE FEET **(BSMTUNF)**

8. Do you have a garage on this property? (CIRCLE)

1. NO (Skip to 9)
2. YES

(GARAGE)

8a. Is the garage attached to the structure? (CIRCLE)

1. NO
2. YES

(GARATT)

8b. How large is the garage in square feet?

________ SQUARE FEET

(GARSQFT)

9. Do you have a carport? (CIRCLE)

1. NO
2. YES

PART II - COSTS AND DAMAGES

The next group of questions is to determine flood damages to different types of property from the 1997 flood.

10. Just before this year's flood, how did you first become aware that flooding might reach your home?

    1. TV **(TV)**
    2. RADIO **(RADIO)**
    3. TELEPHONE BY A PUBLIC OR EMERGENCY WORKER **(TELEPUB)**
    4. TELEPHONE BY OTHER **(TELEOTH)**
    5. FACE TO FACE BY PUBLIC OR EMERGENCY WORKER **(FTFPUB)**
    6. FACE TO FACE BY OTHER **(FTFOTH)**
    7. LOUDSPEAKER **(LDSPEAK)**
    8. SIREN **(SIREN)**
    9. C.B., HAM RADIO or POLICE SCANNER **(CBHMPS)**
    10. NEWSPAPER **(NWSPR)**
    11. OBSERVING THE CREEK OR RIVER WATER LEVELS **(OBSERVE)**
    12. OTHER ______________________________ **(OTHSRC)**

    10a. How many hours were there between the time you became aware that flooding might reach your home until the water actually reached your property?

    ______ HOURS **(WARNTIME)**

11. What actions, if any, did you take to safeguard your property immediately prior to the flooding? (Please circle all that apply.)

    1. Moved contents to higher ground. **(HIGRND)**
    2. Elevated contents to a higher spot in the building. **(HIBLDG)**
    3. Shut off electrical equipment. **(ELECOFF)**
    4. Sandbagged the outside of the building. **(SANDBAG)**
    5. Used another type of temporary barrier. **(OTHBAR)**
    6. Moved vehicles to higher ground. **(MOVEVHCL)**
    7. Other______________________________ **(OTHACT)**

11a. What was the dollar amount of content damage that you prevented by any emergency actions?

$ ______________ CONTENT DAMAGE PREVENTED **(CONTPREV)**

11b. What was the dollar amount of structure damage that you prevented by any emergency actions?

$ ______________ STRUCTURE DAMAGE PREVENTED **(STRPREV)**

12. Did the flooding make it necessary for you or other members of your household to stay in temporary residence due to evacuation or while your home was being repaired?

(CIRCLE)

1. NO (Skip to 12)
2. YES **(TEMPRES)**

12a. How many days did you or will you spend in temporary residence due to the evacuation or while flood damage to your home was being repaired?

_____ DAYS **(DAYSTEMP)**

12b. How much money did your household spend, or will you spend, on travel, beyond your normal travel expense, and lodging (including trailer rental) due to your evacuation(s) this year?

______ DOLLARS **(TRVLCOST)**

12c. Due to your evacuation, how much money did your household spend, or will you spend, on food in excess of what you normally would have spent?

______ DOLLARS **(FOOD)**

13. For each motor vehicle, including cars, trucks, recreational vehicles, boats, and motorcycles, located at this residence during the flood, please indicate the dollar value, whether or not it was moved, the amount of damage to the vehicle, if any, and the level, in feet and inches, that the flood water reached above the bottom of the vehicle's wheels.

Vehicle (Make, model, and Year)	Dollar Value	Was it Moved? (Yes or no)	Dollar Damage	Depth Above Ground At Vehicle
Vehicle 1: **(V1MAKE)** **(V1MODEL)** **(V1YR)**	**(V1VAL)**	**(V1MOVE)**	**(V1DAM)**	**(V1DEPTH)**
Vehicle 2: **(V2MAKE)** **(V2MODEL)** **(V2YR)**	**(V2VAL)**	**(V2MOVE)**	**(V2DAM)**	**(V2DEPTH)**
Vehicle 3:	**(CONTINUE**	**AS**	**NEEDED)**	
Vehicle 4:				
Vehicle 5:				
Vehicle 6:				

The following questions are to determine the dollar cost and unpaid hours for repair and cleanup of your home, and repair, replacement, and cleanup to the contents of your home that resulted from the 1997 flood.

14. What was the dollar cost of the structural damage to your home? (Structural damage is defined as damage to any building components, including foundation, walls, floors, windows, roof, electrical systems, heating and cooling systems, plumbing, attached carpeting, attached shelves and cabinets, and built-in equipment and appliances).

$________________ **(STRDAM)**

15. What was the dollar cost of flood damage to the contents of your home? (Only content repairs, do not include repairs to the structure of the house).

$____________________ **(CONTDAM)**

16. What was the dollar cost to you for labor and supplies to clean up the structure and contents of your house after the flood?

$_________________ **(CLNUPREP)**

17. What was the total number of unpaid hours that you and others spent on repair and cleanup to your home and its contents?

______ HOURS **(UNPDHRS)**

18. How much, if anything, did each of the following cost you in actual dollar expenditures as a result of all of the flooding this year?

a) Costs for moving furniture and other belongings? $______ **(MVGCOST)**

b) Costs for storing furniture and other belongings? $______ **(STORCOST)**

c) Vandalism, looting, or theft costs? $______ **(VANCOST)**

d) Costs from flooding-related medical problems? $______ **(MEDCOST)**

e) Any other costs due to the 1997 flood $______ **(OTHCOST)**

Describe: ________________________________ $______

____ $______

19. How high in feet and inches did the water get relative to the first floor of the inside of your home?

______FEET; ______INCHES (ABOVE, BELOW) FIRST FLOOR LEVEL
[CIRCLE] **(DEPTH)**

20. How many hours did the water remain in your home?

______________ HOURS **(DURATION)**

To be answered by interviewer:

1. What is the five-digit zip code of this home?

_____________ **(ZIPCODE)**

2. Classify the quality of this building.

☐

eg. Fair/Average 2.5

   1. Low
   2. Fair
   3. Average
   4. Good
   5. Very Good
   6. Excellent **(QUALITY)**

3. What is the effective age of this building?

_______ YEARS **(EFFAGE)**

4. What is the condition of this building? **(COND)**

☐

eg. Average/Good 3.5

   1. Worn Out
   2. Badly Worn
   3. Average
   4. Good
   5. Very Good
   6. Excellent

5. What category best describes the style of this building?

(CIRCLE)

1. One-Story
2. Two-Story
3. Three-Story
4. Split Level
5. 1-1/2 Story Finished
6. 1-1/2 Story Unfinished
7. 2-1/2 Story Finished
8. 2-1/2 Story Unfinished
9. 3-1/2 Story Finished
10. 3-1/2 Story Unfinished
11. Bi-Level

(BLDSTYLE)

6. What category best describes the heating and cooling system in this building?

(CIRCLE)

Heating Only:

1. Forced Air
2. Gravity Furnace
3. Floor Furnace
4. Wall Furnace (No Heat Ducts)
5. Floor, Radiant Hot Water
6. Ceiling, Radiant Electric
7. Baseboard, Electric
8. Baseboard, Hot Water
9. Radiators, Hot Water
10. Radiators, Steam

(HEATCOOL)

Heating and Cooling:

11. Warmed and Cooled Air
12. Heat Pump System

Cooling Only:

13. Evaporative Water Cooler (Single or Short Ducts)
14. Refrigerated, with Condenser and Ducts

7. What is the primary exterior wall covering on this building?

(CIRCLE)

1. Plywood
2. Hardboard Sheets
3. Siding
4. Shingle
5. Masonry
6. Common Brick
7. Face Brick
8. Stone
9. Concrete Block

8. What is the primary roof covering of this building?

1. Composition Shingle
2. Built-up Rock
3. Wood Shingle (Embedded in Asphalt)
4. Wood Shake
5. Concrete Tile
6. Clay Tile
7. Galvanized Metal
8. Slate
9. Composition Roll
10. Plastic Tile

(ROOFTYPE)

9. How many single and double fireplaces are in this home?

________ SINGLE FIREPLACES **(NUMSFRPL)**

________ DOUBLE FIREPLACES **(NUMDFRPL)**

10. How many square feet of each of the following types of porches are there in this home?

Open Slab ___________ SQUARE FEET **(OPPORCH)**

Slab on Ground ___________ SQUARE FEET **(SOGPORCH)**

11. Not counting the basement, attic of garage, what percentage of the interior walls and ceilings in this home are covered in plaster?

________ PERCENT **(PRCTPLAS)**